REMARKS

Claims 1-9 are pending in this application. Claims 1, 8 and 9 are herein amended. New claims 30-32 are herein added. No new matter has been added.

Support for the newly amended claims may be found in the as-originally filed specification, for example see the English Translation of PCT application of the present application paragraph [0014], page 6.

Support for the newly added claims may be found in the as-originally filed specification, for example see the English Translation of PCT application of the present application paragraphs [0028] and [0029], pages 13 and 14.

Claim Rejections under 35 U.S.C. §112

Claims 1 and 8-9 were rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. Applicants respectfully traverse this rejection.

Claims 1 and 8-9 are herein amended for clarification.

Favorable reconsideration is earnestly solicited.

Claim Rejections under 35 U.S.C. §103

Claims 1-9 and 20-24 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Domoto et al. (JP 09-207289) (hereinafter Domoto). Applicants respectfully traverse this rejection.

Explanation of the cited art

Domoto discloses the film structural material and uppermost layer containing photocatalysts of the film structural material is made of PTFE. According to Domoto, the

uppermost layer containing photocatalysts must have a tolerance to the strong redox, *i.e.* oxidation and reduction effects of photocatalysts which is generated by the ultraviolet irradiation. If the material of uppermost layer has no tolerance to the strong redox effects of photocatalysts, it will be degraded and finally becomes a powder of the material. This phenomenon is known to a skilled artisan as the chalk effect. There was a need for another material having no chalk effect from other than PTFE for uppermost layer containing photocatalysts.

Domoto discloses that the uppermost layer is provided with a layer containing PTFE and photocatalyst powder. However, in order for said sheet to be thermally welded for lap joint, since, unlike other fluorocarbon resins melt viscosity of PTFE is quite high and photocatalysts are contained, weld intensity for practical use could not be attained unless heated for an unrealistically long time. Here, melt viscosity of PTFE is 10^{10} to 10^{12} Pa·s, whereas the melt viscosity of other fluorocarbon resins is 10^{2} to 10^{6} Pa·s. Thus, a skilled artisan at the time of invention could not have used the uppermost layer made of PTFE containing photocatalysts of the film structural material. A discovery of the presently claimed invention was a material other than PTFE for uppermost layer containing photocatalysts. At the time of invention, there was no known suitable material of fluorocarbon resin for the uppermost layer containing photocatalysts which, at the same time, has a tolerance to the strong redox effects of photocatalysts and has a thermally welded property for lap joint.

As disclosed in the present specification, several experiments were conducted and the inventors of the presently claimed invention discovered the presently claimed fluorocarbon resin

layer for the uppermost layer containing photocatalysts having at least the following unexpected results and/or characteristics:

(a) Tolerance – A tolerance to the strong redox effects of photocatalysts, which is generated by the ultraviolet irradiation, *i.e.* chalk effect free another fluorocarbon resin other than PTFE.

(b) Weld Intensity of lap joint – Since photocatalysts are introduced to the uppermost layer, weld intensity of photocatalyst sheet will be degraded with the increase of contents of photocatalysts. Applicants investigated the weld intensity for chalk effect free another fluorocarbon resin other than PTFE, as disclosed in Domoto.

(c) Lifetime and Antifouling – Confirmation of lifetime test of photocatalyst sheet in addition to antifouling test were conducted on the disclosed Example of the present specification. Applicants tested outdoor exposure test for 12 months. See the English Translation of PCT application of the present application, paragraph [0061] and [0062] and Figs. 15 and 16.

Explanation of the presently claimed invention

An objective of the presently claimed invention is to achieve a new photocatalyst sheet in which substrates coated with fluorocarbon resin are ready weldable mutually. Another objective of the presently claimed invention is to achieve a high antifouling property by coating the outermost surface of film/fabric structure with fluorocarbon resin containing photocatalyst.

Several features of claim 1 of the present application, which are unobvious from the cited art, are:

(i) a photocatalyst sheet comprising a substrate made of glass fiber; a first fluorocarbon resin layer made of polytetrafluoroethylene (PTFE) coated on said substrate; a second fluorocarbon resin layer made of copolymer of tetrafluoroethylene-hexafluoropropylene (FEP), or copolymer of tetrafluoroethylene-perfluoroalkylvinylether (PFA) coated on said first fluorocarbon resin layer; and a third fluorocarbon resin layer consisting of copolymer of tetrafluoroethylene-hexafluoropropylene (FEP) containing photocatalysts at least of titanium oxide (TiO_2 or TiO_3), coated on said second fluorocarbon resin layer; of which said photocatalysts have the part exposed on said third fluorocarbon resin layer; the ratio of said photocatalysts in said third fluorocarbon resin layer is 10-60 weight %; and

(ii) the surface of the fluorocarbon resin layer containing said photocatalysts of said photocatalyst sheet is water repellent upon ultraviolet light irradiation, and

(iii) when said photocatalyst sheets are thermally welded to each other, and if a welded part is peeled off at the rate of 20 mm/min, then the first fluorocarbon resin layer, second fluorocarbon resin layer and, the third fluorocarbon resin layer as a whole layer is completely peeled off from said substrate.

Explanation of unobvious differences between presently claimed invention and the cited art

The presently claimed photocatalyst sheet achieves unexpected results over the cited art. For example, in the presently claimed invention, the uppermost surface of a substrate is coated with the third fluorocarbon resin layer made of FEP containing photocatalysts, said layer has lower melting point than the first fluorocarbon resin layer is 10-60 weight%, thereby mutual

thermal welding of the third fluorocarbon resin layers or others can be easily conducted, and the strength of the thermally welded parts is not deteriorated.

Therefore, in a photocatalyst sheet of the presently claimed invention, thermal weldability is unexpectedly good between the photocatalyst sheets containing photocatalysts. Furthermore, the strength feature of the presently claimed invention is not deteriorated. See Applicants' English Translation of the PCT application of the present application, paragraph [0066] and Figs.14 to 16.

A photocatalyst of the presently claimed invention have a part exposed on the third fluorocarbon resin layer and the ratio of the photocatalyst in the fluorocarbon resin layer is 10-60 weight%, thereby the uppermost surface of the third fluorocarbon resin layer containing photocatalyst has water repellency upon ultraviolet light irradiation. A high antifouling property can also be attained by the photocatalytic action of said uppermost surface of the presently claimed invention. See Applicants' English Translation of the PCT application of the present application, paragraphs [0061] and [0062] and Figs. 15 and 16.

In the presently claimed invention, when said photocatalyst sheets are thermally welded to each other, one may see that the thermal weldability of said thermally welded parts is unexpectedly good. Moreover, a peel off test was conducted at the thermally welded part at the rate of 20 mm/min. In said peel off test, it was observed that an example was defined as good, if fluorocarbon resin layers were completely melted, and the whole fluorocarbon resin layer was completely peeled off from glass fiber as a substrate. It was defined as no good if peeling off occurred between other fluorocarbon resin layers.

Based on the results of the peel off test, it would be obvious to a skilled artisan that the thermal weldability is good for a photocatalyst sheet of the presently claimed invention. Furthermore, the presently claimed photocatalyst sheet may be suitable for structures for outdoor use. See Applicants' English Translation of the PCT application of the present application, paragraph [0059] and Figs.15 to 16.

Furthermore, in the photocatalyst sheet of Domoto, which has the structure comprising a PTFE layer without containing photocatalysts and an uppermost PTFE layer containing photocatalysts coated above the PTFE layer without containing photocatalysts, the photocatalyst sheet cannot be thermally welded for lap joint. This is due to the practical application, as discussed above, i.e. chalk effect and unrealistic heating time.

On the contrary, the presently claimed photocatalyst sheet has a structure comprising a second fluorocarbon resin layer made of FEP or PFA coated on said first fluorocarbon resin layer without containing photocatalysts; and a third fluorocarbon resin layer consisting of FEP containing photocatalysts at least of titanium oxide, coated on said second fluorocarbon resin layer. The presently claimed photocatalyst sheet can be thermally welded to each other, the uppermost FEP layer containing photocatalysts is a chalk free layer and has a long life for outdoor film/fabric structure. These are at least some of the unexpected results of the presently claimed photocatalyst sheet. See the Declaration under 37 C.F.R. §1.132 by Hiroshi Toyoda and Declaration under 37 C.F.R. §1.132 by Kazuhiro Abe.

In other word, in the presently claimed photocatalyst sheet tolerance, weld intensity and lifetime/antifouling properties are improved over the cited art.

The presently claimed photocatalyst sheet can be used for practical applications as disclosed in the present specification. See Applicants' English Translation of the PCT application of the present application, paragraph [0071], page 33. The presently claimed photocatalyst sheet is now a commercially available product.

Moreover, Domoto does not disclose, teach, suggest or provide any reason for achieving improved tolerance, weld intensity and lifetime/antifouling properties. Furthermore, the unexpected results achieved by the presently claimed photocatalyst sheet are not rendered obvious and/or achieved by the sheet of Domoto.

The presently claimed invention differs from Domoto technologically.

In Domoto, the disclosed film comprises the structure of a glass fibrous fabric 1, the two surfaces of which are provided with silicon resin layers, PTFE layers, which cover the surface of the layer 2; layers 4 containing PTFE powders and glass beads which cover layers 3; layers 5, which are fluororesin layers containing titanium oxide photocatalyst, wherein the photocatalyst particles are exposed on the surfaces; the fluororesin is selected from PTFE, FEP, PFA, PCTFE, PVDF, PETFE. See Domoto, paragraphs [0011] to [0014] and Fig. 1.

Domoto also discloses that the fluororesin layer 5 containing titanium oxide photocatalyst may be selected only from PTFE, FEP, PFA, PCTFE, PVDF and PETFE. See Domoto, paragraph [0013].

However, the combination of the layer 5 made of FEP containing titanium oxide photocatalyst and other layers 3 and 4 made of PTFE is not disclosed, taught, suggested or provided for in Domoto. Moreover, in the disclosure and examples of Domoto, all the layers 5

are made of PTFE, which is the same material as layers 3 and 4. See Domoto, paragraph [0018] and [0020] to [0033].

In Domoto, layer 4 contains PTFE powders and glass beads. However, in the presently claimed invention, the second layer of the photocatalyst sheet does not contain PTFE powders and glass beads, nor is PTFE powder and glass beads necessary to achieve the unexpected results of the presently claimed invention.

Since the second layer of the photocatalyst sheet of the presently claimed invention is made of FEP or PFA layer, not containing glass beads, the adhesivity between the first layer and the third layer was unexpectedly improved.

Therefore, in the presently claimed invention the fluorocarbon resin layer was completely peeled off from glass fiber as a substrate in the peel-off test. The photocatalyst sheets are thermally welded together, in such a manner as for making tent storage from a film/fabric structure. The second layer of the photocatalyst sheet of the presently claimed invention achieves good thermal weldability over the cited art.

Domoto discloses a film/fabric structure material, but the welding properties of its photocatalyst sheet, as mentioned above, are not disclosed, taught, suggested or provided for. Assuming the photocatalyst sheets of Domoto are thermally welded together and the peeling test is conducted, the peel-off between the surfaces of each photocatalyst sheet or between the layers 4 containing PTFE powders and glass beads and upper most surface layer containing photocatalyst 5 may occur, to the best of Applicants' knowledge. Hence, the photocatalyst sheet

of Domoto may not be used for thermal welding, and thus may not be used for making film/fabric structures.

Domoto discloses a film/fabric structure material, but does not disclose, teach, suggest or provide any reason for the water repellency being given upon ultraviolet light irradiation to FEP as the uppermost layer of a fluorocarbon resin layer containing photocatalysts, as recited in the presently claimed invention. The unexpected high antifouling property of the presently claimed invention may be due to the water repellency feature of the presently claimed invention. Thermal welding is also possible due to said FEP layer, and that the whole fluorocarbon resin layer is completely peeled off from a substrate when photocatalysts are thermally welded to each other and said welded part is peeled off at the rate of 20 mm/min. See the Declaration under 37 C.F.R. §1.132 by Hiroshi Toyoda and Declaration under 37 C.F.R. §1.132 by Kazuhiro Abe.

Domoto discloses that the uppermost layer is provided with a layer containing PTFE and photocatalyst powder. However, in order for said sheet to be thermally welded, since, unlike other fluorocarbon resins, melt viscosity is quite high, and photocatalysts are contained, weld intensity for practical use could not be attained unless heated for an unrealistically long time. Here, melt viscosity of PTFE is 10^{10}-10^{12} Pa·s, whereas that of other fluorocarbon resins it is 10^{2}-10^{6} Pa·s.

That is, if photocatalyst sheets of Domoto are thermally welded to each other under the same welding condition as in the presently claimed invention for complete weldability, and the welded part is peeled off at the rate of 20 mm/min, then the whole fluorocarbon resin layer made of PTFE is not completely peeled off from a substrate, and weldability is not good. This is due

to incomplete welding of the fluorocarbon resin layer made of PTFE. See the Declaration under 37 C.F.R. §1.132 by Hiroshi Toyoda and Declaration under 37 C.F.R. §1.132 by Kazuhiro Abe.

Therefore, in a case where a photocatalyst sheet of Domoto is used as a film/fabric structure material, one would have a problem achieving the required intensity. Hence, a photocatalyst sheet of Domoto may not be practical to use as the film/fabric structure material.

On the other hand, photocatalyst sheets of the presently claimed invention can attain good thermal weldability when thermally welded to each other under the same welding condition and the welded part is peeled off at the rate of 20 mm/min, then the whole fluorocarbon resin layer is completely peeled off from a substrate. That is, it was recognized that fluorocarbon resin layers were completely welded, and welding intensity was good for use as a structure material, thus resulting in the presently claimed invention. This is an unobvious feature of the presently claimed invention over the disclosure of Domoto.

As discussed above, Domoto does not disclose, teach, suggest or provide any reason for achieving the features of the presently claimed invention. Furthermore, the presently claimed invention achieves unexpected results over the disclosure of Domoto.

Domoto discloses the film structural material comprising a PTFE layer without containing photocatalysts and an uppermost layer containing photocatalysts.

While Domoto may disclose the film structural material comprising a PTFE layer without containing photocatalysts and an uppermost layer containing photocatalysts, Domoto does not disclose, teach, suggest or provide any reason for achieving:

(i) a photocatalyst sheet comprising: a substrate made of glass fiber; a first fluorocarbon resin layer made of polytetrafluoroethylene (PTFE) coated on said substrate; a second fluorocarbon resin layer made of copolymer of tetrafluoroethylene-hexafluoropropylene (FEP), or copolymer of tetrafluoroethylene-perfluoroalkylvinylether (PFA) coated on said first fluorocarbon resin layer; and a third fluorocarbon resin layer consisting of copolymer of tetrafluoroethylene-hexafluoropropylene (FEP) containing photocatalysts at least of titanium oxide (TiO_2 or TiO_3), coated on said second fluorocarbon resin layer; of which said photocatalysts have the part exposed on said third fluorocarbon resin layer; the ratio of said photocatalysts in said third fluorocarbon resin layer is 10-60 weight %; and

(ii) the surface of the fluorocarbon resin layer containing said photocatalysts of said photocatalyst sheet is water repellent upon ultraviolet light irradiation, and

(iii) when said photocatalyst sheets are thermally welded to each other, and if said welded part is peeled off at the rate of 20 mm/min, then the first fluorocarbon resin layer, second fluorocarbon resin layer and, the third fluorocarbon resin layer as a whole layer is completely peeled off from said substrate.

Please note that "[t]he adhesion in front is the adhesion to the PTFE layer containing the glass bead of the PTFE layer containing photocatalyst-titanium-oxide particles." See Domoto, paragraph [0033].

The thermal weldability of the presently claimed photocatalyst sheet means that the first fluorocarbon resin layer, the second fluorocarbon resin layer and the third fluorocarbon resin

layers are thermally welded and then these three layers are peeled off from the glass fiber substrate.

Thus, the adhesion in Table 1 of Domoto is different from and does not render obvious the mutual thermal weldability feature of the presently claimed photocatalyst sheet.

Domoto discloses that the uppermost layer is provided with a layer containing PTFE and photocatalyst powder. However, in order for said sheet to be thermally welded, since, unlike other fluorocarbon resins melt viscosity of PTFE is quite high and photocatalysts are contained, weld intensity for practical use could not be attained unless heated for an unrealistically long time. Here, melt viscosity of PTFE is 10^{10} to 10^{12} Pa·s, whereas the melt viscosity of other fluorocarbon resins is 10^{2} to 10^{6} Pa·s.

That is, if photocatalyst sheets of Domoto are thermally welded to each other by the same welding condition as the presently claimed invention for complete weldability and the welded part is peeled off at the rate of 20 mm/min, then the whole fluorocarbon resin layer made of PTFE is not completely peeled off from a substrate, and weldability is no good in Domoto. This is due to incomplete welding of the fluorocarbon resin layer made of PTFE.

Therefore, in the case wherein the photocatalyst sheet of Domoto is used as a film/fabric structure material, there is a problem that required intensity that is not attained, and hence it is not practically used as a film/fabric structure material.

On the other hand, the presently claimed photocatalyst sheet can attain good thermal weldability when thermally welded to each other by the same welding condition as above, and

the welded part is peeled off at the rate of 20 mm/min, then the whole fluorocarbon resin layer is completely peeled off from a substrate. That is, a skilled artisan would recognize that the presently claimed fluorocarbon resin layers may be completely welded, and welding intensity is good for use as a structure material, thus achieving the presently claimed invention.

Applicants respectfully hold that the thermal weldability described above is not rendered obvious and/or even achieved from the disclosure of Domoto.

Domoto does not disclose, teach, suggest or provide any reason for achieving the presently claimed photocatalyst sheet. Furthermore, the presently claimed photocatalyst sheet achieves unexpected results over Domoto.

Applicants respectfully request reconsideration and withdrawal of this rejection.

In view of the above, Applicants respectfully submit that the claimed invention is allowable and ask that the rejection under 35 U.S.C. §112 and the rejection under 35 U.S.C. §103 be reconsidered and withdrawn. Applicants respectfully submit that this case is in condition for allowance and allowance is respectfully solicited.

If any points remain at issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the local exchange number listed below.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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Enclosures: Declaration under 37 C.F.R. §1.132 by Hiroshi Toyoda
Declaration under 37 C.F.R. §1.132 by Kazuhiro Abe